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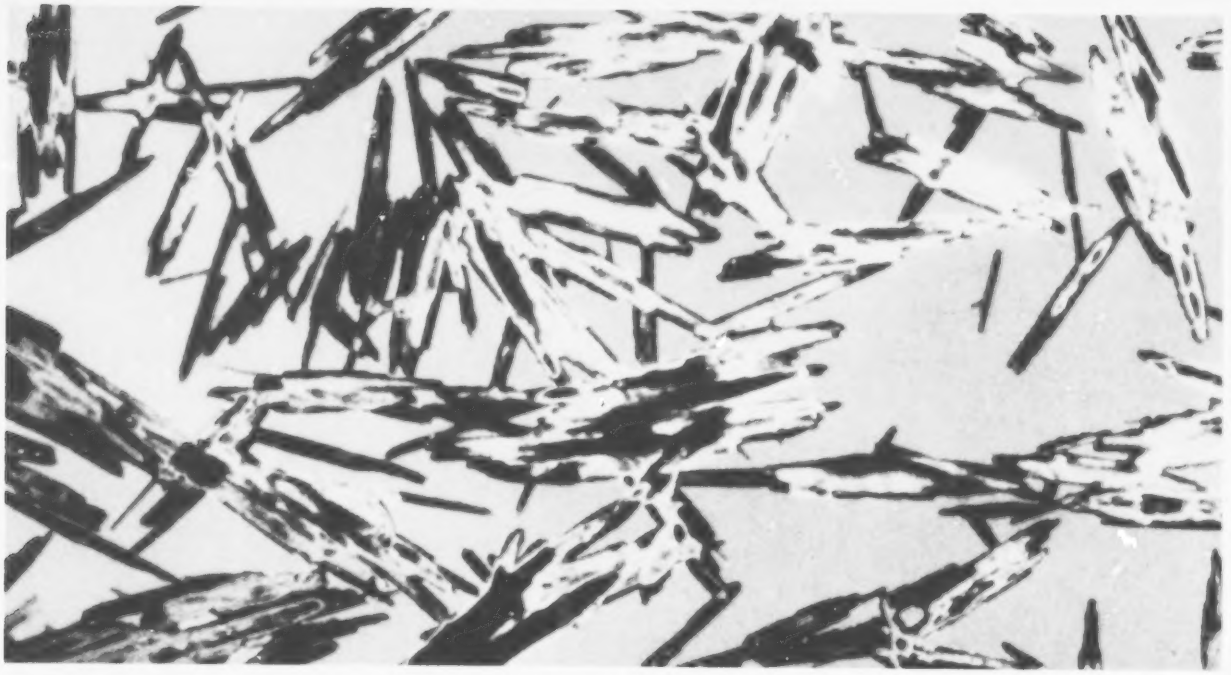

IRON OXIDE PIGMENTS

By Donald P. Mickelsen

1989

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

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U.S.
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Director

September 1990

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COVER PHOTO:
An optical photomicrograph shows yellow synthetic iron oxide pigment particles magnified 30,000 times. Average particle length is 0.4 micrometers. (Photo is courtesy of Mobay Corp., Inorganic Chemicals Div., Pittsburgh, PA. Mobay is a Bayer USA Inc. company.)

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IRON OXIDE PIGMENTS

By Donald P. Mickelsen

Mr. Mickelsen, a mineral industry specialist with 16 years Bureau of Mines experience, has been the commodity specialist for iron oxide pigments since 1985. Domestic survey data were prepared by the author, and international data tables were prepared by Audrey D. Wilkes, international data assistant.

U.S. mine production of crude iron oxide pigments increased significantly over that of 1988, while shipments increased moderately and value decreased. Total domestic shipments of finished natural and synthetic iron oxide pigments remained relatively unchanged from those of 1988. Synthetic iron oxides comprised 61% of all shipments. The sale of the Columbian Chemicals Inc.'s synthetic iron oxide business to Mobay Corp. was blocked by the Federal Trade Commission in March 1990.

Construction materials was the largest end use for iron oxide pigments, followed, in order of rank, by paints and coatings; colorants for ceramics, glass, paper, plastics, rubber, and textiles; ferrites; industrial chemicals; foundry sands; animal feed and fertilizer; and other end uses.

List prices for iron oxide pigments remained unchanged from those in 1988. Price increases proposed by one major producer had little effect on the market because of competitive pricing.

The United States imported more than twice as much iron oxide pigment in 1989 as it exported, but an exact comparison with 1988 data could not be made because of the conversion to the Harmonized Tariff Schedule by the U.S. International Trade Commission and the consequent incompatibility of the 1989 and 1988 classifications. Exports of pigment-grade iron oxides decreased substantially compared with those of 1988. U.S. imports for consumption of natural iron oxide pigments decreased substantially while synthetic iron oxide pigments increased slightly, resulting in an overall slight decrease in iron oxide pigment imports. Imports of natural iron oxide pigments are no longer delineated by color. Synthetic black pigment imports increased significantly, although synthetic red and yellow pigments imports increased only slightly. World mine production of natural iron oxide pigments for reporting countries also increased slightly in 1989.

LEGISLATION AND GOVERNMENT PROGRAMS

On January 1, 1989, U.S. Customs regulations and tariff schedules were modified in accordance with the Omnibus Trade and Competitiveness Act (Public Law 100-418) enacted by Congress on August 23, 1988. This law was passed in order to enhance the competitiveness of the Nation's industries and to improve the management of U.S. trade strategy. Subtitle B of the new law required that all tariff schedules conform to the nomenclature of the internationally established Harmonized System—a global system of classifying products for tariff purposes.

The new law restructured both the import and export classification systems. The new schedule B classification is now based on the organizational framework of the Harmonized Tariff Schedule of the United States. That is, equivalent import and export items are assigned the same 10-digit classification code. In the case of iron oxide pigment imports, 10 subheadings that applied to natural iron oxide pigments have been replaced by 4 less definitive codes, which also include the synthetic iron oxide pigments. The four synthetic import subheadings are now represented by statistical subdivisions. Iron oxide pigment exports are also represented by the same four subheadings as the imports.

Public Law 100-418 also requires

TABLE 1

SALIENT U.S. IRON OXIDE PIGMENTS STATISTICS

		1985	1986	1987	1988	1989
Mine production	metric tons	29,242	30,744	31,816	30,747	42,034
Crude pigments sold or used	do.	42,261	37,183	38,803	39,711	45,575
Value	thousands	$2,826	$2,908	$3,598	$3,815	$3,645
Finished pigments sold	metric tons	115,051	116,444	124,293	126,640	127,665
Value	thousands	$122,716	$126,388	$136,427	r$134,325	$134,567
Exports	metric tons	26,962	26,164	20,184	21,966	1 9,966
Value	thousands	$27,574	$30,830	$31,689	$33,014	$15,700
Imports for consumption	metric tons	36,105	33,360	38,394	38,929	1 36,669
Value	thousands	$22,565	$21,517	$20,680	$27,128	$30,540

r Revised.
1 Data reflects conversion to the Harmonized Tariff Schedule, effective Jan. 1, 1989, Public Law 100-418, Subtitle B.

that U.S. Government agencies implement the use of metric units in their business activities by the end of fiscal year 1992. All of the iron oxide pigment trade statistics collected by the Bureau of the Census are now being compiled and published in metric units, as required by that law. Consequently, the Bureau of Mines will publish its iron oxide pigment statistics in metric units and has converted all numbers in the text and iron oxide pigment tables to metric tons, unless otherwise stated. To convert from metric tons to short tons, multiply by 1.10231.

PRODUCTION

Mine production of crude iron oxide pigments increased 37% over that of 1988, and shipments increased a moderate 15%. The bulk of these increases were attributed to stockpiling of crude material by one producer and an increase of sales for nonpigmentary purposes by another. Lower valued nonpigmentary iron oxide sales also accounted for an overall decrease in value of crude shipments of 4%. Four companies mined and shipped various grades of iron oxide pigments. One company in Georgia mined and shipped ocher; magnetite was mined and shipped by a company in Missouri; and, of two companies in Virginia, one mined and shipped sienna, umber, and ocher, and the other shipped umber. Cleveland Cliffs Iron Co., which permanently closed its Mather Mine in northern Michigan in 1979, continued to ship hematite from stockpiles. A new company, Swansea Minerals Inc., shipped minor amounts of a micaceous, specular hematite processed from mine tailings at the Swansea Mine, La Paz County, AZ.

Total domestic shipments of finished natural and synthetic iron oxide pigments, excluding regenerator oxide, steel plant waste, and magnetic iron oxide, remained relatively unchanged from those of 1988 in both quantity and value. Shipments of finished natural iron oxide pigments increased slightly in both quantity and value. These increases were influenced mainly by increases in the black magnetite and red iron oxide categories, which accounted for almost three quarters of the natural iron oxides shipped. Synthetic iron oxide pigments, which dominate the industry, comprised about two thirds of total shipments and experienced slight decreases in quantity in 1989, while total value remained essentially unchanged from 1988 levels. Slight decreases in shipments of synthetic iron oxide pigments occurred across the board, although value remained constant.

Iron oxides recovered from steel-plant wastes, including regenerator oxide and steel-plant dust, were reported by six domestic companies in 1989. Shipments totaled 30,745 tons and were valued at $4,163,000. Perox Inc., a regenerator oxide producer based in Pittsburgh, PA, was added to the Bureau of Mines survey in 1989. Of the remaining five companies who reported shipments, two showed increases, one remained the same, and two showed decreases when compared with those of 1988.

Pigment-grade iron oxides for use in magnetic applications were produced domestically in 1989, but are not included in table 2. Production and shipment data for magnetic iron oxides are not publishable because of their proprietary nature.

Domestic iron oxide pigment producers underwent a year of acquisition activities in 1989. In January, Cambrex Inc., a company that had an agreement in principle to purchase Pfizer Pigment Inc., one of three dominant domestic producers, terminated that agreement owing to a lack of business performance in the second half of 1988.[1] In August, Columbian Chemicals Co. announced it had signed a letter of intent to sell its iron oxide pigment plant in St. Louis, MO, to Mobay Corp., a

TABLE 2

FINISHED IRON OXIDE PIGMENTS SOLD BY PROCESSORS IN THE UNITED STATES, BY KIND

Kind	1988		1989	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Natural:				
Black: Magnetite	6,334	$1,228	10,253	$2,129
Brown:				
Iron oxide	W	W	W	W
Umbers:				
Burnt	W	W	W	W
Raw	W	W	W	W
Red:				
Iron oxide[1]	23,528	4,064	26,395	4,710
Sienna, burnt	W	W	W	W
Yellow:				
Ocher	W	W	W	W
Sienna, raw	W	W	W	W
Undistributed	15,810	8,141	12,725	7,218
Total[2]	45,671	13,433	49,373	14,057
Synthetic:				
Brown: Iron oxide[3]	24,254	r35,077	23,621	36,048
Red: Iron oxide	34,081	r52,334	32,748	50,833
Yellow: Iron oxide[4]	22,634	r33,482	21,923	33,629
Other: Speciality oxides	(5)	(5)	(5)	(5)
Mixtures of natural and synthetic iron oxides	(5)	(5)	(5)	(5)
Total[2]	80,969	r120,892	78,292	120,510
Grand total[2]	126,640	r134,325	127,665	134,567

r Revised. W Withheld to avoid disclosing company proprietary data; included with "Undistributed."
[1] Includes pyrite cinder.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes synthetic black iron oxide.
[4] Includes other specialty oxides and mixtures of natural and synthetic iron oxides.
[5] Included with synthetic yellow iron oxide to avoid disclosing company proprietary data.

TABLE 3

PRODUCERS OF IRON OXIDE PIGMENTS, REGENERATOR IRON OXIDES, AND STEEL-PLANT WASTE IRON OXIDES IN THE UNITED STATES IN 1989

Producer	Mailing address	Plant location
Finished pigments:		
American Minerals Inc.	Box 677 Camden, NJ 08101	Camden, NJ.
Blue Ridge Talc Co. Inc.	Box 39 Henry, VA 24102	Henry, VA.
Columbian Chemicals Co.	303 Hofmeister St. Louis, MO 63125	St. Louis, MO, and Monmouth Junction, NJ.
Cyprus Specialty Metals Co.	301 Lindenwood Dr., Suite 301 Milwaukee, WI 53207	Frazer, PA.
Hilton-Davis Co.	2235 Langdon Farm Rd. Cincinnati, OH 45237	Cincinnati, OH.
Hoover Color Corp.	Box 218 Hiwassee, VA 24347	Hiwassee, VA.
Mobay Corp., Inorganic Chemicals Div.	Mobay Rd. Pittsburgh, PA 15205	New Martinsville, WV.
New Riverside Ochre Co.	Box 387 Cartersville, GA 30120	Cartersville, GA.
Pea Ridge Iron Ore Co.	Route 4 Sullivan, MO 63080	Sullivan, MO.
Pfizer Pigment Inc.	640 North 13th St. Easton, PA 18042	Emeryville, CA; East St. Louis, IL; Easton, PA.
Prince Manufacturing Co.	700 Lehigh St. Bowmanstown, PA 18030	Quincy, IL, and Bowmanstown, PA.
Solomon Grind-Chem Services Inc.	Box 8288 Springfield, IL 62791	Springfield, IL.
Crude pigments:		
Cleveland-Cliffs Iron Co., Mather Mine and Pioneer plant (closed July 31, 1979; shipping from stockpile.)	1100 Superior Ave. Cleveland, OH 44114	Negaunee, MI.
Hoover Color Corp.	Box 218 Hiwassee, VA 24347	Hiwassee, VA.
New Riverside Ochre Co.	Box 387 Cartersville, GA 30120	Cartersville, GA.
Pea Ridge Iron Ore Co.	Route 4 Sullivan, MO 63080	Sullivan, MO.
Swansea Minerals Inc.	6360 E. Rose Circle Dr. Scottsdale, AZ 85251	Tempe, AZ.
Virginia Earth Pigments Co.	Box 1866 Pulaski, VA 24301	Hillsville, VA.
Regenerator and steel plant waste iron oxides:		
Armco Inc.	P.O. Box 191 Ashland, KY 41101	Ashland, KY.
Gulf States Steel Inc.	174 South 26th St. Gadsden, AL 35904	Gadsden, AL.
Perox	95 32nd St. Pittsburgh, PA 15201	Birmingham, AL, and Sharon, PA.
Petco Inc.	225 S. 600 East Lehi, UT	Lehi, UT.
Shance Chemical Corp.	1 Depot Plaza Mamaroneck, NY 10543	Philadelphia, PA.
Weirton Steel Corp.	400 Three Springs Rd. Weirton, WV 26062	Weirton, WV.

subsidiary of the Federal Republic of Germany company Bayer AG. Columbian Chemicals and Mobay are the remaining two of the three dominant domestic synthetic iron oxide pigment producers, and the sale was subject to Federal Trade Commission (FTC) approval. This sale was subsequently blocked by the FTC, which cited restricted trade as justification for seeking an injunction on the sale.[2]

CONSUMPTION AND USES

Iron oxide pigments were consumed mainly as an ingredient in construction materials; in coatings; and as colorants for ceramics, glass, paper, plastics, rubber, and textiles. Consumption data shown in this chapter represent domestically produced and shipped iron oxide pigments as reported by producers. The United States also imports iron oxide pigments, which are distributed through various trading firms and color companies as well as by some of the domestic iron oxide pigment producers. The Bureau of Mines is unable to ascertain the end-use applications of these imported materials. End-use data shown in table 4 were based on data reported by producers to the Bureau of Mines and do not include imported iron oxide pigments, except for possible minor amounts mixed with domestic materials.

Consumption of iron oxide pigments in construction materials continued to be the largest end use. Use of domestically produced iron oxide pigments in construction material accounted for more than one-third of all shipments, the same as in 1988, and totaled 45,000 tons in 1989. In recent years construction use has been greater than the traditionally largest end use, paint and coatings, and was the end use with the most growth potential, because iron oxide pigment use in colored concrete blocks and roofing tiles was expanding. According to one study by F. W. Dodge, the Information Systems Div. of McGraw-Hill Co., newly started construction was valued at $261.2

billion in 1989, remaining practically the same as that of 1988. Construction starts varied by region: the north-central and western regions had gains of 5% and 1%, respectively. Nonresidential building was the strongest sector during the year, increasing 3% to a value of $93.1 billion; although the actual volume of work decreased 4%. Residential construction declined slightly to $120.4 billion; single-family homes remained stable, and apartment and condominium construction was down 8%. Nonbuilding construction, including public works and utilities, also declined slightly to $47.7 billion, principally owing to a large drop in highway and bridge construction.[3]

Coatings, the second largest use for iron oxide pigments, accounted for almost one-fourth of the iron oxide pigment consumption in 1989, decreasing slightly to 30,730 tons from 31,400 tons in 1988. Shipments for lacquer, paint, and varnish, as reported by the U.S. Department of Commerce, totaled about 1 billion gallons of coatings valued at $11.6 billion, down slightly in volume but up 7% in value over those of 1988. Architectural coatings comprised 51% of all shipments and totaled 533 million gallons; product coatings (original equipment manufacture) was 33% of shipments, or 337 million gallons; and special purpose coatings shipments were 16%, or 167 million gallons.[4]

Of all iron oxides, 17%, or 22,000 tons, were consumed as colorants for plastics, glass and ceramics, paper and textiles, and rubber, by order of rank. This was practically the same amount consumed in 1988. Iron oxide pigments were popular for these uses because of their low cost, coloring effectiveness in thermoplastics and thermosets, and acceptance by the Food and Drug Administration for food contact and medical applications.

The remaining 24% of reported iron oxide pigment consumption, in order of rank, was for use in foundry sands, industrial chemicals, ferrites, the manufacture of animal feed and fertilizers, and other end uses, including cosmetics, magnetic tape and magnetic ink, and polishing agents.

Regenerator oxides and steel-plant dust, not accounted for in table 4, were consumed mainly for use in the manufacture of ferrites, with lesser amounts used as colorants for cements and construction materials, industrial chemicals, foundry use, glass and ceramics, and fertilizers.

Magnetic iron oxides, also not included in table 4, were used mainly in the manufacture of ferromagnetic ceramics, magnetic media such as magnetic tapes and floppy disks, and in magnetic inks and toners.

PRICES

Domestic list prices for natural and synthetic grades of iron oxide pigments sold in 1989 by major producers remained practically unchanged from those of 1988. Although at least one major producer tried to increase prices beginning in the second quarter, competition from other producers discouraged this effort. The iron oxide pigment industry is an extremely competitive industry, and although some of the larger companies would like to increase prices to compensate for higher costs for labor, operations, and raw materials, competition from others makes this difficult. Synthetic iron oxides are the standard for the industry because they have the most consistent colors, highest tincture strength, and are easily dispersed. For these reasons, they command the highest prices and make up the greatest amount consumed. The competitive nature of the industry, however, has lowered the return for the companies involved and is one reason for the upheaval in ownership. Toward the end of the fourth quarter, prices were firming with little or no dis-

TABLE 4

ESTIMATED IRON OXIDE PIGMENT CONSUMPTION,[1] BY END USE, AS A PERCENTAGE OF REPORTED SHIPMENTS

End use	All iron oxides		Natural iron oxides		Synthetic iron oxides	
	1988	1989	1988	1989	1988	1989
Coatings (industrial finishes, trade sales: lacquers, paints, varnishes)	25	24	16	17	30	29
Construction materials (cement, mortar, preformed concrete, roofing granules)	35	35	29	23	39	42
Colorants for ceramics, glass, paper, plastics, rubber, textiles	17	17	18	21	16	14
Foundry sands	6	5	17	12	—	(2)
Industrial chemicals (such as catalysts)	5	5	W	1	W	7
Ferrites	W	W	W	W	W	W
Animal feed and fertilizers	4	5	9	11	W	W
Other (including cosmetics, magnetic tape and magnetic ink, and polishing agents)	[3]8	[3]9	[4]11	[3]15	[5]15	[6]8
Total	100	100	100	100	100	100

W Withheld to avoid disclosing company proprietary data; included with "Other."
[1] Data do not include magnetic iron oxide usage.
[2] Less than 1/2 unit.
[3] Includes ferrite iron oxide usage.
[4] Includes industrial chemical and ferrite iron oxide usage.
[5] Includes industrial chemical, ferrite, and animal feed and fertilizer iron oxide usage.
[6] Includes ferrite and animal feed and fertilizer iron oxide usage.

counting for bulk shipments. It was apparent that the new year would bring price increases of about 5 to 6 cents per pound for synthetic colors.[5]

Prices for imported iron oxide pigments also remained at 1988 levels. According to the American Paint and Coatings Journal, list prices for Italian burnt sienna were 50 to 78 cents per pound; for Turkish burnt umber, 47.5 to 56 cents per pound; and for Spanish red, 33.5 cents per pound.

FOREIGN TRADE

Trade statistics show that the United States imported 268% more iron oxide pigments than it exported in 1989. This apparently large trade imbalance was partly the result of the conversion of the U.S. foreign trade data system to the Harmonized Tariff Schedule on January 1, 1989, as required by Public Law 100-418. This law changed the classification codes for both iron oxide pigment imports and exports. Therefore, an exact comparison could not be made.

TABLE 5

PRICES QUOTED ON FINISHED IRON OXIDE PIGMENTS, PER POUND,[1] DECEMBER 31, 1989

Pigment	Low	High
Black:		
Natural	$0.1400	$0.2800
Synthetic	.7400	.9400
Brown:		
Natural	.1400	.2000
Metallic	.1900	.3950
Umber, burnt	.4700	.7000
Umber, Turkish, burnt[2]	.4750	.5600
Umber, raw	.4700	.6700
Vandyke brown	—	.5000
Synthetic	.7800	.8650
Red:		
Natural	.1950	.5000
Sienna, burnt	.5600	.7500
Sienna, Italian, burnt[2]	.5000	.7800
Synthetic	.5000	.9900
Spanish[2]	—	.3350
Yellow:		
Ocher	.1300	.5100
Sienna, raw	.5500	.6400
Synthetic	.7200	.9800
Micaceous:	.2700	.2700

[1] Prices shown represent list prices provided by domestic producers but are not to be considered definite or necessarily reflect contract prices for bulk shipments.
[2] American Paint and Coatings Journal.

U.S. exports of pigment-grade iron oxides and hydroxides decreased 55% in quantity and 52% in value when compared with those of 1988. However, because of the Harmonized Tariff Schedule classification changes, these data are not comparable. An analysis of the export data of the other grade iron oxide which increased 273% in quantity and 105% in value, indicated that pigment grade material was most likely included in this category. This analysis is based on the decrease in value of these other grades, which previously had a much greater average value, owing to the inclusion of magnetic materials in this category.

Exports of pigment-grade iron oxides went to 42 countries in 1989, principally in Asia, North America, and Europe. Chief destinations for iron oxide pigments were the Republic of Korea, Canada, and the Federal Republic of Germany. Exports of other grades of iron oxides and hydroxides were shipped mainly to the Federal Republic of Germany, Mexico, Japan, the Republic of Korea, and the United Kingdom, in order of rank.

U.S. imports for consumption of iron oxide pigments decreased 6% in quantity from those of 1988, but increased 13% in value. Imports were received from 19 countries in 1989, 1 more than in 1988. Imports of synthetic iron oxide pigments increased slightly in quantity and 17% in value. Synthetic iron oxides composed 86% of all imports received. Synthetic black, red, and yellow grades all increased in quantity, with the black grade showing a significant increase over that of 1988. The "other" category, including synthetic brown oxides, transparent oxides, and magnetic and precursor oxides, showed a sharp decrease. Synthetic iron oxides were received chiefly from Canada, the Federal Republic of Germany, Mexico, Japan, and the United Kingdom, in order of rank. Canada and the Federal Republic of Germany supplied 66% of the total synthetic iron oxides imported; Mexico, Japan, and the United Kingdom supplied 28%; and the remaining 6% were imported from other countries. Data on synthetic iron oxides imported from Canada were as reported by the Bureau of the Census. It is likely, however, that a large portion of this material reported as a synthetic iron oxide pigment was misclassified, and was actually a regenerator iron oxide. This was apparent, because one of the two Canadian companies exporting iron oxide material into the United States was a steel-plant operator, not a pigment producer.

U.S. imports of natural iron oxide pigments decreased 36% for both quantity and value from those of 1988. Unit value for natural iron oxide pigment imports remained unchanged. Since the conversion to the Harmonized Tariff Schedule, there no longer exist classification codes for the natural iron oxide pigment grades. In order to remedy this situation, the Bureau of Mines submitted a request to the U.S. International Trade Commission to reinstate classifications for natural iron oxide pigment colors. The large quantity of the natural micaceous iron oxides imports reported by the Bureau of the Census in 1989 was most likely misclassified material, particularly those shown from Canada. The chief supplier of micaceous iron oxides to the United States was Austria, from which 92 tons were received in 1989. Canada, Cyprus, the Federal Republic of Germany, and Spain, in order of rank, supplied 97% of all imports of natural iron oxides, and the remaining 3% came from other countries. Imports received from Cyprus were primarily of crude and finished sienna and umber grades; from the Federal Republic of Germany, primarily Vandyke brown; and from Spain, natural red hematite and ocher. Minor amounts of natural and synthetic iron oxide pigments were received and stored in bonded warehouses for future consumption.

WORLD REVIEW

World mine production of natural iron oxide pigments for reporting countries increased slightly in 1989, totaling 283,000 tons, up from 276,000 tons in 1988. Of the reporting countries, India reported the greatest production, more than one-half of the world total. Other large producers of natural iron oxide pigments were the United States, Spain, France, and Cyprus, ranked in the or-

TABLE 6

U.S. EXPORTS OF IRON OXIDES AND HYDROXIDES, BY COUNTRY

Country	1988				1989[1]			
	Pigment grade		Other grade		Pigment grade		Other grade	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Argentina	12	$19	18	$64	10	$50	59	$208
Australia	287	463	557	893	292	357	732	1,404
Austria	—	—	—	—	14	18	—	—
Belgium-Luxembourg	60	244	388	685	43	43	433	877
Brazil	38	91	236	925	192	823	110	331
Bulgaria	—	—	41	139	—	—	—	—
Canada	3,436	5,549	361	522	1,316	2,195	1,087	3,538
Chile	10	46	—	—	1	2	—	—
China	16	100	—	—	16	73	31	113
Colombia	107	146	127	172	5	7	132	185
Costa Rica	4	8	—	—	—	—	—	—
Cyprus	5	8	—	—	—	—	—	—
Denmark	54	120	17	20	—	—	—	—
Dominican Republic	7	8	2	5	66	78	—	—
Ecuador	7	13	5	10	—	—	—	—
Egypt	—	—	39	57	—	—	—	—
El Salvador	—	—	—	—	20	36	—	—
Finland	9	16	—	—	18	33	18	33
France	432	1,639	130	284	235	1,397	156	852
Germany, Federal Republic of	10,258	8,642	498	1,715	1,292	2,010	12,236	12,644
Greece	—	—	19	29	—	—	42	29
Guatamala	21	20	—	—	71	63	—	—
Honduras	5	10	7	16	—	—	10	20
Hong Kong	658	1,771	262	1,117	538	1,567	504	1,566
India	40	111	442	2,318	56	169	185	771
Indonesia	29	116	11	30	38	42	200	137
Ireland	57	109	4	6	30	62	29	57
Israel	(2)	2	6	3	16	8	—	—
Italy	458	2,050	5	14	23	49	1,090	2,094
Jamaica	(2)	2	1	3	104	50	1	3
Japan	3,362	4,601	719	758	2,141	1,758	4,117	4,584
Korea, Republic of	553	856	2,887	12,605	427	995	3,538	13,777
Macao	—	—	—	—	—	—	73	104
Malaysia	29	35	13	17	43	43	54	95
Mexico	315	588	1,312	1,914	207	383	4,949	4,815
Netherlands	265	529	177	418	572	735	644	1,317
Netherlands Antilles	—	—	—	—	7	8	—	—
New Zealand	13	16	3	8	42	51	11	36
Pakistan	—	—	54	149	—	—	(2)	14
Peru	20	29	1	13	10	4	—	—
Philippines	106	127	116	199	121	195	106	121
Saudi Arabia	—	—	—	—	128	143	—	—
Singapore	16	66	120	377	164	537	202	408
South Africa, Republic of	37	244	—	—	44	65	854	693
Spain	22	50	75	86	116	190	10	11
Sweden	—	—	5	13	—	—	1	4
Switzerland	44	161	4	15	12	46	—	—
Taiwan	89	313	67	70	200	223	66	136

See footnotes at end of table.

TABLE 6—Continued

U.S. EXPORTS OF IRON OXIDES AND HYDROXIDES, BY COUNTRY

Country	1988				1989[1]			
	Pigment grade		Other grade		Pigment grade		Other grade	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Thailand	114	367	88	136	680	426	33	57
Trinidad	([2])	6	—	—	99	50	1,046	132
U.S.S.R.	—	—	100	60	200	139	3	20
United Kingdom	870	3,542	325	655	355	571	1,828	3,315
Venezuela	96	161	13	42	([2])	5	33	31
Yugoslavia	—	—	30	50	—	—	—	—
Other	5	19	2	7	—	—	9	33
Total[3]	21,966	33,014	9,286	26,618	9,966	15,700	34,631	54,567

[1] Data reflect conversion to the Harmonized Tariff Schedule, effective Jan. 1, 1989, Public Law 100-418, Subtitle B.
[2] Less than 1/2 unit.
[3] Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 7

U.S. IMPORTS FOR CONSUMPTION OF SELECTED IRON OXIDE PIGMENTS, BY TYPE

Type	1988		1989[1]		Major sources, 1989[2] (metric tons)
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thosands)	
Natural:					
Earth colors[3]	7,717[4]	2,132[4]	2,135	999	Cyprus 1,772; West Germany 317; Spain 20; Belgium 19; Nigeria 6.
Micaceous	([5])	([5])	2,826	355	Canada 2,418; Spain 274; Austria 92; France 40; Japan 1; United Kingdom 1.
Total[2]	7,717	2,132	4,961	1,354	
Synthetic:					
Black	5,109	1,430	7,550	11,441	Canada 4,518; Japan 2,224; West Germany 739; China 27; Mexico 19; Dominican Republic 19; United Kingdom 3; Sweden 1.
Red	10,124	4,657	11,599	4,675	Canada 6,121; West Germany 2,495; Mexico 1,207; Japan 958; Sweden 360; Brazil 121; Austria 102; Spain 101; Venezuela 80; Belgium 53; Dominican Republic 2.
Yellow	10,117	7,849	10,681	8,594	West Germany 4,256; Mexico 2,572; Canada 1,584; United Kingdom 1,244; Brazil 660; Spain 304; China 39; Venezuela 21.
Other[6]	5,861	11,061	1,878	4,476	West Germany 690; Japan 520; Canada 470; Netherlands 116; Mexico 57; Belgium 21; United Kingdom 4.
Total[2]	31,212	24,996	31,708	29,186	
Grand total[2]	38,929	27,128	36,669	30,540	

[1] Data reflect conversion to the Harmonized Tariff Schedule, effective Jan. 1, 1989, Public Law 100-418, Subtitle B.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes finished and crude natural ocher, sienna, umber, Vandyke brown, and other natural iron oxide pigments.
[4] Includes micaceous iron oxide pigments.
[5] Included with earth colors.
[6] Includes synthetic brown oxides, transparent oxides, and magnetic and precursor oxides.

Source: Bureau of the Census.

TABLE 8

U.S. IMPORTS FOR CONSUMPTION OF IRON OXIDE AND IRON HYDROXIDE PIGMENTS, BY COUNTRY

Country	Natural				Synthetic			
	1988		1989[1]		1988		1989[1]	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Austria	34	$10	92	$91	105	$119	102	$24
Belgium-Luxembourg	(2)	3	20	13	298	142	74	221
Brazil	—	—	—	—	668	470	781	603
Canada	478	170	2,418	156	13,712	3,036	12,693	3,564
China	—	—	—	—	—	—	66	32
Cyprus	4,507	833	1,772	382	—	—	—	—
Dominican Republic	—	—	—	—	—	—	21	29
France	(2)	2	40	25	182	477	—	—
Germany, Federal Republic of	1,455	417	317	550	8,954	8,522	8,180	6,720
Japan	383	272	1	7	2,574	8,493	3,702	13,152
Korea, Republic of	—	—	—	—	44	139	—	—
Mexico	(2)	3	—	—	3,365	2,363	3,855	3,020
Netherlands	16	6	—	—	413	247	116	101
Nigeria	—	—	6	22	—	—	—	—
Norway	—	—	—	—	2	3	—	—
Peru	1	151	(2)	31	—	—	—	—
Spain	751	195	294	71	387	387	405	311
Sweden	—	—	—	—	1	19	362	115
Switzerland	—	—	—	—	(2)	2	1	6
United Kingdom	92	70	1	7	568	570	1,251	1,199
Venezuela	—	—	—	—	—	—	101	90
Other	—	—	—	—	(2)	9	—	—
Total[3]	7,717	2,132	4,961	1,354	31,212	24,996	31,708	29,186

[1] Data reflect conversion to the Harmonized Tariff Schedule, effective Jan. 1, 1989, Public Law 100-418, Subtitle B.
[2] Less than 1/2 unit.
[3] Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

der named. Together with India, these countries produced 86% of the world total in 1989. In addition to the countries listed in table 9, other countries, including the centrally planned economy countries, produced natural iron oxide pigments in 1989. Production data for these countries, however, were not available. Natural red iron oxide was produced primarily by India and Spain; yellow ocher by Spain, the United States, Brazil, and the Republic of South Africa; and sienna by Cyprus and Italy. Cyprus was the major umber producer; Austria was the principal micaceous iron oxide producer; and the Federal Republic of Germany was the main Vandyke brown producer.

Synthetic iron oxides were one of the largest consumed colored inorganic pigments in the world. Their popularity was attributed to a favorable performance-price relationship. Iron oxides exhibit high tinctorial strength and hiding power, chemical resistance, lightfastness, and weatherfastness at low pigmentation costs. Synthetic iron oxides have made continuous gains in total market share over natural iron oxides because of product consistency, higher tinting strengths, and more saturated color shades compared with natural grades. Principal world producers of synthetic iron oxides, in order of rank, included the Federal Republic of Germany, the United States, the United Kingdom, and Japan.

According to the Japan Inorganic Chemical (Pharmaceutical) Industry Association, shipments of iron oxides in Japan were expected to increase 3% in 1989, growing to 215,300 tons. This was an increase similar to that experienced in 1988. In 1989, iron oxides used for magnetic materials, the dominant end use in Japan, were estimated to be 154,000 tons. Iron oxide pigment consumption in Japan in 1989 was estimated to be 30,000 tons, 42% of which was used in paints and the remainder in roads, construction materials, printing inks, synthetic resins, ceramics, papermaking, and other end uses, listed by order of rank. Another 31,000 tons of iron oxides was estimated to have been exported. Japan was producing more iron oxides from steel operations than it could consume in 1988, when it had iron oxide stocks of 25,000 tons. Iron oxide consumption in Japan is forecast to grow only slightly in the early 1990's. Japanese ferrite producers were operating at capacity, and increased ferrite production is expected in the United States.[6]

In the United Kingdom, the Cookson Group PLC and Magnesium International Corp. Ltd. formed a joint-venture company named Cookson Laminox Ltd. to manufacture synthetic

micaceous iron oxide (MIO). Based on a patented process developed by MPLC Laboratories Ltd., this technology will produce a synthetic iron oxide having the same lamellar characteristics as natural MIO, which impedes moisture penetration in paints and resists corrosion. The plant, having a capacity of 10,000 tons per year, was to be constructed at Peterlee near Durham. It was to ultimately create 40 jobs. Production was to begin in late 1989, and the pigment was to be marketed under the trade name Laminox.[7]

OUTLOOK

The outlook for the U.S. iron oxide pigment industry is expected to be one of continued growth despite a slight decrease in 1989. Domestic shipments of finished iron oxide pigments are forecast to range from 141,000 tons to 153,000 tons by 1995. It is probable that shipments will reach the middle range of this forecast. Principal factors are the continued popularity of earth-toned colors, continued growth in construction activities, and continued growth in paint and coatings production. The low forecast of 141,000 tons would result principally from an increased demand for other pigment materials used as substitutes for iron oxide pigments, from a decrease in construction activities, or from a decrease in paint and coatings demand.

Shipments of domestic iron oxide pigments for use in construction materials are expected to continue increasing moderately and to help push probable iron oxide pigment requirements to the middle range of the forecast. Consumption for use in paint and coatings is expected to experience slower growth. Projected growth rates indicate that the probable overall demand for domestic iron oxide pigments in the United States in 1995 will be 148,000 tons, representing an annual growth rate of 2.4%.

This forecast is based on the average annual growth rate of the gross national product (GNP) as prepared for the Bureau of Mines by DRI, a subsidiary of McGraw-Hill, which provides macroeconomic forecasting services. Iron oxide pigments used in construction materials in 1995 were forecast to range between 49,000 and 53,000 tons; end use for paint and coatings between 34,000 and 37,000 tons; and pigments used as colorants for ceramics, glass, paper, plastics, rubber, and textiles to range between 24,000 and 26,000 tons. Other end uses are expected to experience similar rates of growth, with the exception of ferrite use, which should reach the high end of the forecast of 3% per year or higher. A higher rate could also materialize if population growth increases at a higher rate than forecast or by changing trends in population movement.

TABLE 9

NATURAL IRON OXIDE PIGMENTS: WORLD MINE PRODUCTION, BY COUNTRY[1]

(Metric tons)

Country[2]	1985	1986	1987	1988[p]	1989[e]
Argentina	4,020	1,027	1,022	815	900
Austria	11,583	11,730	10,807	9,938	9,000
Brazil	r6,320	r5,474	5,803	r e6,000	6,000
Canada[e]	2,000	2,000	2,000	2,000	2,000
Chile	8,224	4,404	8,145	8,542	8,300
Cyprus	12,200	10,000	12,500	10,060	10,000
France[e]	14,500	15,000	15,000	15,000	15,000
Germany, Federal Republic of[3]	15,761	11,365	10,003	r e8,000	5,000
India	108,549	98,668	145,245	r e145,000	145,000
Iran[e 4]	5 4,300	4,300	4,300	4,300	4,300
Italy[e]	850	875	850	850	800
Pakistan (ocher)	553	608	1,792	1,040	1,000
Paraguay[e]	260	250	285	250	250
South Africa, Republic of	752	1,501	768	1,797	1,800
Spain:[e]					
Ocher	5 10,293	10,500	10,500	10,500	10,500
Red iron oxide	21,000	20,000	r20,500	r20,500	20,500
United States	29,242	30,744	31,816	30,747	5 42,034
Zimbabwe[e]	1,000	5 207	200	5 363	300

[e] Estimated. [p] Preliminary. [r] Revised.

[1] Table includes data available through Apr. 13, 1990.

[2] In addition to the countries listed, a considerable number of others undoubtedly produce iron oxide pigments, but output is not reported, and no basis is available for formulating estimates of output levels. Such countries include (but are not limited to) China and the U.S.S.R. Because unreported output is probably substantial, this table is not added to provide a world total.

[3] Includes Vandyke brown.

[4] Iranian calendar year (Mar. 21 to Mar. 20), beginning in the year stated.

[5] Reported figure.

[1] Chemical Marketing Reporter. Pfizer Iron Oxides Won't Go to Cambrex. V. 235, No. 3, Jan. 16, 1989, p. 4.

[2] ———. FTC Would Block Mobay Acquisition. V. 237, No. 12, Mar. 19, 1990, p. 4.

[3] American Paint and Coatings Journal. Building Starts Decline in 1989. V. 74, No. 38, pp. 15–16.

[4] Bureau of the Census (Dep. of Commerce). Paint, Varnish, and Lacquer. Rep. M28F(89)-12, 1989.

[5] American Paint and Coatings Journal. The Markets. Various Issues 1989.

[6] Roskill Information Services Ltd. (London). Roskill's Letter From Japan. Ferric Oxide: Japanese Demand Estimated to Grow by 3% to 215,300 Tons in 1989. RLJ No. 163, Nov. 1989, pp. 6–7.

[7] Pigment and Resin Technology (London). Cookson and Magnesium International in Joint Venture. Feb. 1989, pp. 22–23.

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